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Corporate performances and market selection. Some comparative evidence

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Abstract

Diverse theories of industry dynamics predict heterogeneity in production efficiency to be the driver of firms' growth, survival and industrial change, either through a direct link between efficiency and growth, or through an indirect effect via profitabilities, as more productive firms can enjoy higher profit margins which, under imperfect capital markets, allow them to invest and grow more. Does the empirical evidence bear such predictions? This paper explores the dynamics of selection and reallocation through an investigation of the productivity-profitability-growth relations at the firm level. Exploiting large panels of Italian and French industrial firms, we find that heterogeneity in efficiencies primarily yield persistent profitability differentials, whereas the relationships of corporate growth with either productivity or profitability appear much weaker, if at all existent. This suggests that selection forces are much less strong than usually assumed. Rather, the links between efficiency and corporate growth seem profoundly mediated by large degrees of behavioural freedom. The results robustly applies across different industrial sectors and across the two countries.

JEL codes: C14, D20, L10, L20, O47

Keywords: firms heterogeneity, corporate growth, productivity, profitability, market selection, cross-country comparisons

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1 Introduction

One of the most general and robust stylized fact in industrial economics, revealed by recent micro evidence on plants and firms, cross-sectionally and over time, is an impressive heterogeneity, on every dimension one is able to observe. The heterogeneity in the “identity cards” of individual entities concerns sizes, degrees of efficiency (however measured), innovativeness, organizational setups, financial structures. This equally applies to the dynamics of all these corporate features, and it also concerns seemingly behavioral characteristics, including the propensity to expand and to invest. And, finally, it regards revealed micro performances, e.g. profitability, growth rates and survival probabilities.[1] Heterogeneity is ubiquitous across sectors and applies generally irrespectively of the degrees of statistical disaggregation of industries. It is very persistent over time in the levels of whatever micro variable one looks at, while often less so in the rates of change of the same variables.

Granted all that, are there some regularities that one can identify concerning the relations between the “identities” of individual entities, plants or firms, and their revealed performances ? And, more specifically, are there systematic links between some micro characteristics which are plausible candidates for the determinants of differential competitiveness, on the one hand, and revealed performances, on the other?

In fact, several models, grounded in diverse theoretical traditions, do predict heterogeneity in production efficiency and/or innovativeness to be the drivers of firms’ growth, survival and industrial change. This applies, first, to the perspectives that we could call of ”equilibrium dynamics”, including the models of Jovanovic (1982), Hopenhayn (1992) and Ericson and Pakes (1995) (see also the extensions to trade in Melitz, 2003). In Jovanovic (1982) firms are characterized by heterogeneous efficiency to begin with. Selection results from a (passive) process of post-entry Bayesian learning: those firms which discover to be efficient enough to ensure non-negative profitability rationally choose to continue their operations and grow, while the others quit the market. The selection process is similar in Ericson and Pakes (1995), but here firms are able to undertake active learning in that they are able to influence their own efficiencies and profitabilities by investing in technological search whose intensity is determined via their rational technological expectations on the stochastic outcomes of search itself. Even more so, heterogeneity is the driver of differential firm growth and industrial dynamics in the models sharing an evolutionary perspective – whose formalizations include Nelson and Winter (1982), Winter (1984), Silverberg et al. (1988), Silverberg and Verspagen (1994), Dosi et al. (1995), Metcalfe (1998), Winter et al. (2000, 2003), Bottazzi et al. (2001). In such a perspective a continuous process of out-of-equilibrium creative destruction is driven by the twin processes of idiosyncratic learning – involving changes in production techniques, output characteristics, organizational practices – and competitive selection amongst persistently different firms. Such differences, in interactive market environments, influence the degrees of competitiveness and, ultimately, the degrees of “fitness” within the population of firms, determining differential growth and survival opportunities.

One of the predictions of theory is that productivity – proxying production efficiency – ought to be positively related to profitability and/or firm growth, at least on average. Depending on the models, this occurs either through a direct link between efficiency and growth – as relatively more efficient firms gain market shares by setting lower prices – or through an indirect effect via profitabilities – as more productive firms can enjoy higher profit

[1]Reviews, covering parts of this broad area, are in Nelson (1981), Dosi (1988, 2007), Caves (1998), Geroski (1998, 2002), Bartelsman and Doms (2000), Ahn (2001), Dosi and Nelson (2009).

margins which in turn allow them to invest more (in presence of endemically imperfect capital markets) and eventually grow more.

The increasing availability of longitudinal micro-data allows to address empirically such relations between efficiency, market selection, profitability and corporate growth and survival.

In this respect, a good deal of effort has gone into the decomposition of aggregate (sectoral or economy-wide) productivity growth, separating (i) idiosyncratic changes in firm/plant productivity levels – the so called *within* component; (ii) changes in average productivity due to reallocation of output or employment shares across firms – the *between* component; and (iii) the contribution thereof due to entry into and exit from the market. Most studies, to a large extent based on plant-level data from North American countries (cfr. Foster et al. (2001), Baldwin and Gu (2006) and the critical surveys in Bartelsman and Doms (2000) and Ahn (2001)) do find evidence of a steady process of creative destruction involving significant rates of input and output reallocation even within 4-Digit industries. Moreover, the process is accompanied by a good deal of "churning" with relatively high flows of entry and exit. Around a half of the new firms in all countries for which there is evidence are dead within the first five years of life (Bartelsman et al., 2005). However, some of those which survive grow in their industry shares and provide a significant contribution to overall productivity growth (Baldwin and Gu, 2006).

Within such a turbulent dynamics in industrial populations and structures, what is the role played, *stricto sensu*, by selection amongst incumbents? That is, how effective are competitive interactions in reallocating resources and output shares in favour of the more efficient firms? Here the evidence is mixed. Start by noting that the *between* component in the decomposition of productivity changes provides only an indirect account of the relation between relative productivity levels and firms' growth. Indeed it just measures the total sum of the changes in firms' shares weighted by their initial productivity levels. Granted that, if we take this component as an indirect measure of the presence of selection dynamics, all seem to suggest that the reallocation pressure due to differential productivities is at best weak or, according to some studies, even "perverse", in that reallocation can go in favour of less productive plants or firms. When the between component has the expected (positive) sign, idiosyncratic learning (the within term) generally offers a comparatively larger contribution to productivity growth. However, the sign is *not* always unequivocally positive. Baily et al. (1996) find that the contribution to productivity growth is equally split between growing and shrinking firms. In a similar vein, Baldwin and Gu (2006) conclude (on Canadian data) that "...the component that measures the effect of compositional changes arising from shifts in employment shares among continuing plants plays a negligible to moderate role in aggregate productivity growth after 1979." (p.438-9), such shifts appearing to be more relevant over the period 1973-79. The evidence in Disney et al. (2003) (on UK data) shows a *negative* between effect.[2]

The possibility for selection to be mediated via profitabilities (and differential investment rates) has been much less studied.[3] One of the few such attempts (Coad, 2007) does not find any robust association between profitabilities and subsequent growth.

In any case, beyond broad decompositions of changes in industry aggregates – as revealing as they are – the natural way forward is to explicitly analyse the statistical relations between

[2]The size and even the sign of the various effects depend a good deal also on the method used. So, for example, Baldwin and Gu (2006) find, too, a negative between term in most sectors , when using the Griliches and Regev (1995) method.

[3]An important caveat here is that one should explicitly disentangle the relation between physical productivities and the ability/willingness to charge higher margins per unit of output. One study that does it, (Foster et al., 2008) shows that in fact the two variables seem to move in opposite directions.

the characteristics of individual firms (for the time being in terms of productivities) and their growth, both directly and indirectly via the relationships between productivity and profitability, and between the latter and growth. Some very preliminary evidence on Italian data is presented in Dosi (2007), Bottazzi et al. (2008, 2005b), hinting at a quite weak power of selection forces. In the following we go much deeper into this type of analysis. In addition to contemporaneous relations we explore longer term structures and we study their dynamics.[4] Moreover, we offer comparative analysis on Italian and French data, trying to illuminate on the degrees to which the properties of the productivity-profitability-growth relationships depend on country-specific institutional characteristics or, conversely, they are relatively generic features of contemporary industrial dynamics. The characteristics of available data on the two countries, covering long time spans and allowing for a fine level of sectoral aggregation, provide robustness to the results.

The paper is organized as follows. In Section 2 we describe the datasets of Italian and French industrial firms. Next, in Section 3, we present intertemporal patterns of sectoral productivities, and perform non parametric analyses of the pairwise relationships between productivity, profitability and growth performance of firms, yielding an initial descriptive picture about the strength of the different associations. We then turn to panel data regressions (Section 4) allowing for unobserved heterogeneity, and we estimate both short run effects and longer time relations.

2 Data and Variables

This paper draws upon two similar datasets, Micro.3 and EAE, reporting firm level information for Italy and France, respectively. The Micro.3 database has been developed through a collaboration between the Italian statistical office (ISTAT) and members of the Laboratory of Economics and Management of Scuola Superiore Sant'Anna, Pisa. The EAE French databank is collected by the statistical department of French Ministry of Industry (SESSI) and provided by the French statistical office (INSEE).[5] The two databanks are open panels combining information from census and/or corporate annual reports about all the firms with 20 or more employees operating in any sector of activity on the national territory. For the present analysis we consider the period 1989-2004 for the EAE database and the period 1991-2004 for Micro.3.[6]

Variables we focus on are productive efficiency, profitability and growth. First, concerning the proxy for growth of the firm (labeled G in the following), our choice is consistent with the general aim of relating such dynamics with the selection and reallocation mechanisms nested in market competition. Thus, we measure firm size in terms of sales, rather than in terms of employees or assets, and G is the log difference of total sales at constant prices, in two consecutive years. Second, our proxy for profitability (henceforth P) is the ratio of gross operating margins (i.e. value added minus cost of labour, GOM), divided by total sales. Third, our proxy of efficiency will be a simple labour productivity index computed as the ratio between

[4] Similar issues are considered in Coad and Broekel (2007) and in Coad et al. (2008) through a VAR analysis, respectively on French and Italian data. Those works however focus on *growth rates* of productivity and profitability, providing a complementary exercise to the one we perform here.

[5] Both databanks have been made available to authors under the mandatory condition of censorship of any individual information.

[6] The EAE dataset also indicates if the firms underwent any king of structure modification such as merger, acquisition, etc. The analysis of French firms only includes firms which do not experienced any such restructuring.

value added and number of employees (henceforth Π). We prefer to use this measure, instead of alternative multi-factor proxies of efficiency, to assure direct comparability of our micro productivity measures with those more aggregated ones available from national accounts. The finding in Foster et al. (2001), that TFP and labour productivity tend to be highly correlated, support the idea that these two measures point in the same direction. The present study focuses on manufacturing firms. Since Bottazzi et al. (2005b), analyzing a similar database, find significant differences in capital intensity across firms inside the same 2-digit sector and since one of our major goals is to understand the strength of selection and reallocation forces ideally operating in each market, we perform the analysis at the finest possible level of sectoral aggregation. This increases the likelihood that we compare firms which are actually competing with each other. Given the number of observations, we undertake an analysis at the level of 3-Digit industries and, among them, we will restrict the attention to those sectors recording at least 100 firms in each year.[7]

The current values variables when required are deflated with the output deflators at the highest level of disaggregation. Consistent 3-Digit price indexes are available for Italy starting in 1991, hence our choice to consider only the period 1991-2004. In the case of France, 3-Digit deflators are available only for the most recent years: thus, we opted for 2-Digit ones, covering the whole 1989-2004 panel.

3 Productivity, profitability and corporate growth: the broad picture and some non-parametric analyses

Table 1 and Table 2 offer an introductory picture of the sectoral tendencies followed by labour productivity in the 3-Digit industries selected for the analysis, for Italy and France respectively (the measures are computed aggregating all the firms present in each sector in a given year).

The birdeye view of the data confirms the poor performance of Italian labour productivity when compared to France. In our database, the aggregate productivity of the Italian manufacturing sector grows in four year, from 2000 to 2004, by a mere 2%. In the same period France sees the productivity of its manufacturing industry grows by more than 10%. Moreover in Italy average productivities in 15 out of 41 3-Digit sectors tend to stop growing or even fall in the new millennium, while the same happens in France only in 9 out of 36 sectors. The interpretation of the sector-wide or even economy-wide factors, if any, influencing such average patterns is beyond the scope of this work. Conversely, the focus here is on the dispersion in firm-specific efficiency underlying the sectoral productivity averages, together with dispersion in profitabilities, and their relation with firm growth. Heterogeneity is indeed the name of the game. The ratios of the 95th to the 5th quantile of firms' productivity distributions are quite high and persistent over time. In Italy they range from 2.78 to 6.02 in 1991 and from 3.28 to 8.55 in 2004, displaying a general growing trend. The same trend is observed in France, when they range from 2.31 to 9.40 in 1991 and from 2.46 to 13.16 in 2004.[8] Similar considerations apply to our profitability measure (figures are not reported but available upon request).

Given the deep and widespread differences in productivity levels among firms belonging

[7] In both datasets, firms are classified according to their sector of principal activity, on the basis of the French NAF 700 classification standards for the French data and on the Italian ATECO 2002 ones for the Italian data. In the following, national industrial classifications are converted to the European NACE (Nomenclatures statistique des activités économiques dans la Communauté européenne) classes - Rev 1.1, with which both ATECO and NAF standards perfectly match.

[8] Detailed results are available upon request.

NACE	SECTOR	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
151	Production, process & preserv. of meat	114.22	125.40	116.68	110.55	101.77	108.94	105.93	115.06	105.99	100.00	99.64	111.02	112.04	108.99
155	Dairy products	100.64	105.95	99.06	97.42	96.50	91.49	95.84	97.27	104.36	100.00	101.18	110.16	110.61	108.37
158	Prod. of other food (bread, sugar, etc)	93.14	99.59	98.36	91.08	89.12	91.49	92.28	94.34	99.48	100.00	104.52	110.38	100.02	107.35
159	Beverages (alcoholic & not)	85.51	91.41	90.85	92.73	89.84	82.47	89.06	98.52	97.67	100.00	91.34	94.89	88.91	84.81
171	Preparation and spinning of textiles	74.28	86.71	91.70	101.43	97.21	93.32	95.08	93.81	94.09	100.00	94.86	91.10	86.16	85.46
172	Textiles weaving	76.69	79.99	85.46	94.05	101.06	94.04	95.80	92.94	95.98	100.00	97.37	96.63	90.95	95.09
175	Carpets, rugs and other textiles	76.69	80.22	86.17	91.18	95.19	92.58	95.81	96.43	94.40	100.00	96.34	94.99	93.22	91.45
177	Knitted and crocheted articles	80.89	87.93	91.82	94.71	105.37	96.91	95.87	96.00	87.89	100.00	99.26	99.01	94.84	103.11
182	Wearing apparel	75.55	81.21	85.32	89.59	99.94	99.38	95.33	98.02	93.00	100.00	105.65	107.82	103.94	110.16
193	Footwear	83.63	81.23	90.64	95.65	103.23	98.78	81.37	90.75	95.73	100.00	107.08	106.07	102.14	107.02
203	Wood products for construction	96.91	106.62	107.38	103.54	106.24	103.13	103.58	98.57	99.38	100.00	102.94	107.51	103.71	104.78
212	Articles of paper and paperboard	80.16	79.71	88.43	94.48	92.15	100.88	101.61	101.00	104.38	100.00	92.80	97.07	98.02	102.13
221	Publishing	66.43	72.22	71.10	71.71	69.03	68.51	78.84	77.81	86.32	100.00	84.59	91.46	94.91	111.72
222	Printing	109.75	113.40	110.62	108.36	99.14	99.80	92.89	98.80	98.56	100.00	104.65	100.22	101.37	103.01
241	Production of basic chemicals	65.34	74.71	75.32	96.07	125.51	99.43	99.54	106.53	97.61	100.00	85.26	88.09	83.40	89.36
243	Paints, varnishes, inks & mastics	94.23	97.19	96.50	100.14	99.92	104.40	95.67	100.48	105.55	100.00	95.25	102.04	110.30	111.79
244	Pharma., med. chemicals, botanical prod	78.84	85.92	87.64	91.09	95.60	99.54	93.18	97.46	99.13	100.00	99.45	104.40	97.67	99.69
246	Other chemical products	80.21	89.17	96.32	102.42	105.93	122.61	112.12	113.55	112.66	100.00	96.88	99.69	90.45	100.62
251	Rubber products	102.06	106.44	113.11	119.20	110.58	99.28	102.71	100.96	103.04	100.00	97.14	102.63	97.41	103.10
252	Plastic products	90.49	95.68	100.66	103.22	102.22	105.02	99.42	99.10	103.42	100.00	97.64	103.18	100.03	98.42
263	Ceramic goods for construction	90.34	95.54	110.77	110.03	111.02	97.19	100.26	100.22	104.50	100.00	91.44	95.13	96.82	101.53
266	Concrete, plaster and cement	84.55	86.82	78.44	79.04	85.24	89.10	87.91	90.45	94.03	100.00	103.17	110.35	107.02	104.33
267	Cutting, shaping and finishing of stone	86.87	94.68	95.82	97.32	100.40	97.81	100.36	93.86	97.30	100.00	94.56	97.25	98.59	100.39
275	Casting of metals	79.38	77.31	79.65	88.46	96.73	92.75	94.39	94.96	97.34	100.00	92.81	101.28	95.13	96.09
281	Structural metal products	94.39	92.16	92.45	90.76	99.13	105.93	106.33	96.50	100.92	100.00	107.98	111.01	107.12	105.92
284	Forging, pressing, stamping, of metal	83.45	89.87	88.30	95.32	106.38	100.27	96.61	97.95	101.23	100.00	103.44	107.16	98.15	91.43
285	Treatment and coating of metals	83.21	82.89	85.38	89.85	97.40	102.52	95.21	94.17	96.99	100.00	102.03	110.03	110.17	113.45
286	Cutlery, tools and general hardware	87.93	88.48	89.71	93.71	96.35	92.91	95.43	93.78	97.04	100.00	100.03	101.76	99.26	104.49
287	Other fabricated metal products	89.05	92.89	96.31	100.07	105.38	102.91	96.91	97.38	96.12	100.00	98.25	98.68	97.04	99.53
291	Machinery for prod. & use of mech. power	81.16	88.59	91.50	99.02	101.84	98.71	92.20	90.27	95.95	100.00	98.59	107.62	102.81	109.09
292	Other general purpose machinery	90.49	93.23	94.77	99.76	103.89	107.39	98.34	97.32	97.17	100.00	100.16	101.89	102.24	104.73
294	Machine tools	84.66	79.91	80.92	87.50	94.61	95.61	94.61	97.11	87.68	100.00	99.15	93.63	84.29	91.21
295	Other special purpose machinery	86.72	86.37	94.46	99.57	105.12	96.78	98.31	92.84	94.52	100.00	99.15	94.13	93.56	97.27
297	Domestic appliances not e/where class	82.10	91.31	99.09	103.59	96.93	96.42	93.76	94.97	103.13	100.00	97.08	104.75	94.44	94.30
311	Electric motors, generators and transform	83.15	81.84	83.81	87.05	92.03	89.62	90.54	88.90	90.25	100.00	91.91	97.52	100.71	98.38
312	Manuf. of electricity distrib, control equ	80.61	84.16	86.07	88.51	98.92	89.09	100.55	90.32	91.85	100.00	104.34	103.60	101.24	106.76
316	Electrical equipment not e/where class	99.42	101.90	100.77	111.56	105.59	99.04	100.30	99.73	100.01	100.00	101.20	102.87	103.85	108.60
343	Production of spare parts for cars	80.95	83.89	84.58	94.74	97.96	90.64	101.09	95.69	103.62	100.00	100.08	104.09	102.87	106.30
361	Furniture	88.70	90.11	93.06	94.63	97.10	90.26	91.13	94.02	96.53	100.00	99.19	95.79	90.37	91.71
362	Jewelry and related articles	80.59	78.77	78.21	79.33	84.72	92.89	88.88	100.04	106.81	100.00	102.34	100.29	102.62	105.53
366	Miscellaneous manufact. not e/where class	73.36	90.00	94.98	95.75	104.54	106.11	93.88	95.21	98.34	100.00	105.47	103.07	109.88	111.68
Total		86.55	90.80	93.22	97.16	101.54	98.84	97.84	95.80	97.39	100.00	98.81	101.69	98.93	102.06

Table 1: Italy – Sectoral Productivities at constant prices in selected 3-Digit industries, index numbers (2000=100).

NACE	SECTOR	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
171	Preparation and spinning of textiles	89.48	80.33	88.72	96.30	95.61	108.82	94.76	91.47	98.23	91.54	89.57	100.00	88.96	93.42	92.04	95.50
172	Textiles weaving	81.58	77.36	77.12	82.25	87.33	95.79	95.51	92.19	93.87	100.36	94.45	100.00	92.44	94.77	92.92	96.59
175	Carpets, rugs and other textiles	84.07	83.77	81.31	89.03	92.49	93.73	91.50	91.07	96.27	98.42	102.13	100.00	93.08	99.36	99.75	104.23
182	Wearing apparel	74.17	81.65	81.20	82.23	84.39	85.40	86.57	86.27	87.81	91.56	96.41	100.00	106.87	115.20	119.97	126.82
193	Footwear	86.42	92.16	96.18	92.95	94.80	94.07	95.09	92.80	95.70	98.18	100.69	100.00	104.56	106.70	101.22	102.70
204	Wooden containers	76.17	80.57	85.06	89.31	94.40	91.17	88.11	94.56	97.26	99.59	103.93	100.00	102.46	104.02	102.44	107.11
211	Pulp, paper and paperboard	85.11	87.22	84.62	72.23	73.85	87.54	105.25	83.72	94.78	99.30	95.69	100.00	105.28	102.18	91.72	90.14
212	Articles of paper and paperboard	83.68	89.43	92.71	96.96	106.12	105.09	93.19	102.04	102.80	102.18	107.64	100.00	102.00	104.16	107.57	108.28
221	Publishing	78.92	78.16	77.60	78.53	80.95	84.61	83.86	86.83	90.69	92.92	96.79	100.00	97.52	99.16	102.69	99.03
222	Printing	99.58	101.73	101.30	102.47	101.79	104.31	104.31	99.91	100.50	98.91	101.26	100.00	96.04	98.64	99.31	103.40
241	Production of basic chemicals	64.08	69.83	69.06	74.04	79.24	90.57	100.91	95.26	104.85	101.34	104.08	100.00	90.23	82.26	94.69	84.81
243	Paints, varnishes, inks & mastics	78.51	84.31	89.27	94.57	103.80	104.57	97.75	97.49	98.22	99.67	106.77	100.00	96.78	97.88	100.11	104.04
244	Pharma., med. chemicals, botanical prod	66.03	68.31	70.39	74.17	78.51	83.85	92.37	91.12	92.16	93.64	97.17	100.00	109.08	115.35	115.31	118.18
245	Soap and deterg & perfumes and toilet prep	83.72	84.53	85.77	90.30	92.46	96.37	99.46	92.33	96.03	92.90	95.81	100.00	100.17	106.57	110.17	116.99
246	Other chemical products	74.19	79.99	80.96	83.47	94.56	100.73	95.65	97.88	96.50	94.89	100.91	100.00	97.63	106.41	104.01	106.12
252	Plastic products	84.23	93.29	97.37	102.83	106.21	109.08	102.72	103.70	102.87	105.44	110.33	100.00	99.21	105.41	107.10	106.19
261	Glass and glass products	01.23	101.83	99.14	93.48	92.45	99.32	100.90	99.75	101.89	102.41	102.86	100.00	99.26	100.20	96.47	94.81
266	Concrete, plaster and cement	87.08	85.82	85.26	84.24	81.84	87.88	90.02	83.48	88.06	94.84	99.32	100.00	98.37	98.42	99.32	105.47
275	Casting of metals	98.45	107.67	108.20	106.68	103.23	106.41	97.56	101.36	103.56	104.57	108.41	100.00	99.82	102.56	105.28	104.40
281	Structural metal products	83.94	83.58	84.02	83.95	83.34	87.98	95.83	88.52	92.44	94.31	97.66	100.00	104.82	105.82	105.79	108.86
283	Steam generators, except central heating	83.66	83.89	85.77	85.01	88.02	101.18	97.78	84.34	91.90	84.46	94.03	100.00	86.96	95.64	95.05	96.26
284	Forging, pressing, stamping, of metal	96.98	101.96	105.38	109.95	107.60	113.48	105.82	101.77	105.25	103.29	106.89	100.00	99.29	103.84	105.13	106.83
285	Treatment and coating of metals	94.75	103.49	105.99	107.13	107.14	105.98	104.89	102.61	100.85	103.12	106.10	100.00	101.09	102.63	102.71	99.62
287	Other fabricated metal products	87.90	97.59	102.17	106.28	104.65	105.80	99.05	97.00	104.68	104.17	109.72	100.00	98.96	105.23	108.37	106.58
291	Machinery for prod. & use of mech. power	72.97	77.56	78.47	82.94	86.18	100.37	100.51	96.79	94.76	95.21	96.16	100.00	103.46	106.18	109.67	115.29
292	Other general purpose machinery	77.45	80.04	79.43	79.39	83.12	90.37	93.48	92.75	93.79	96.87	97.77	100.00	100.93	103.39	108.19	113.42
293	Agricultural and forestry machinery	78.17	78.54	73.23	75.71	82.64	98.19	103.79	102.40	106.18	97.84	100.45	100.00	92.02	99.39	90.70	104.14
294	Machine Tools	81.82	81.36	76.78	79.27	78.15	87.43	94.05	91.69	93.03	100.14	98.64	100.00	99.60	93.77	95.47	102.70
295	Other special purpose machinery	72.73	74.63	71.92	73.41	79.06	87.96	90.14	86.57	93.07	97.15	96.82	100.00	95.00	95.35	96.58	98.93
311	Electric motors, generators and transform	48.58	55.19	58.70	58.66	63.15	67.03	71.15	73.39	82.44	91.01	97.85	100.00	103.66	111.20	116.84	125.37
321	Elect valves & tubes, other elect components	53.20	53.28	55.86	60.45	65.39	72.03	76.72	77.45	83.05	83.75	90.00	100.00	92.03	97.41	103.27	115.86
331	Medical & surgical equip, orthopedic appl	43.36	50.85	54.55	56.82	70.28	72.45	72.83	72.59	78.82	77.94	92.30	100.00	106.27	100.21	102.36	109.41
332	Measuring, checking, testing &navigat app.	55.06	59.18	57.57	55.70	58.01	66.75	70.85	76.81	84.50	83.18	88.83	100.00	112.93	118.14	126.81	133.26
333	Industrial process control equipment	58.06	62.30	71.63	68.19	73.01	74.23	85.28	81.04	85.43	90.14	101.14	100.00	99.78	90.99	101.99	121.31
361	Furniture	91.47	92.89	94.71	95.11	96.23	98.25	98.75	96.49	98.67	100.94	103.82	100.00	97.22	102.19	103.89	110.41
366	Manufacturing n.e.c.	84.90	85.21	81.41	87.89	92.05	92.60	97.19	96.27	100.83	96.98	98.11	100.00	104.35	110.24	111.09	115.46
Total		76.31	79.58	81.13	83.44	86.68	92.36	93.49	92.36	95.72	96.89	100.84	100.00	99.63	103.68	107.02	110.12

Table 2: France – Sectoral Productivities at constant prices in selected 3-Digit industries, index numbers (2000=100).

	Within(%)	**Between(%)**	**Interaction(%)**
	$\sum_i \Delta\Pi_i s_i(t)$	$\sum_i \Delta s_i \Pi_i(t)$	$\sum_i \Delta\Pi_i \Delta s_i$
Italy	103.73	41.39	-45.12
France	121.43	63.38	-84.81

Table 3: Decomposition of Productivity growth, cross-sectoral mean contributions.

to the same 3-digit sector, it is interesting to investigate how these differences relate with the observed aggregate behaviour. Some hints can be obtained performing a decomposition exercise. Let $L_{i,t}$ and $VA_{i,t}$ be the number of employees and the value added of firm i at time t. The aggregate labour productivity of sector j can be computed as

$$\Pi_{j,t} = \frac{\sum_{i \in j} VA_{i,t}}{\sum_{i \in j} L_{i,t}} = \sum_{i \in j} \Pi_{i,t}\, s_{i,t}$$

where the summation is over all firms i belonging to sector j and where $s_{i,t} = L_{i,t} / \sum_{i \in j} L_{i,t}$ represent the employment share of firm i in its sector. The annual variation of sectoral productivity can thus be decomposed as

$$\Delta\Pi_{j,t} = \Pi_{j,t+1} - \Pi_{j,t} = \sum_i \Delta\Pi_i s_i(t) + \sum_i \Delta s_i \Pi_i(t) + \sum_i \Delta\Pi_i \Delta s_i \ .$$

The first term represents the *within* effect, i.e. the contribution of firm-specific productivity changes holding constant the share of the firm in the industry. The second term is a *between* effect, capturing the overall contribution due to variation in firm shares, holding initial productivities constant. Finally, the third term is an *interaction* effect, accounting for co-variations between firm productivities and shares. We obtain these three measures for each sector and for each year in our database, then compute their percentage contribution to $\Delta\Pi_{j,t}$ and average the obtained percentages across all years and sectors. Results are reported in Table 3.[9] The variability across sectors and across years is quite high.[10]. In general, however, idiosyncratic learning (the within component) tends to dominate upon selection effects (the between component). And the apparent low effectiveness of selection dynamics is further highlighted by the generally negative impact of the covariance effects: those firms which increase more their productivities tend to undergo shrinking shares.

Exercises of "evolutionary accounting" such as those summarised in Table 3, however, just present broad tendencies, in that they sum up the different effects over all firms in an industry. Much finer interpretations can only come from the analysis of the relationships between efficiency and growth at the level of individual firms. This is precisely what we shall do in the following, in two steps. First we directly explore the relationship between productivity and growth, the firm-level equivalent of the decomposition analysis done above. Second, by considering firm profitability, we decompose the productivity-growth interaction in two pieces, and explore the association of productivity with profit margins, on the one hand, and the relationship between profit margins and growth, on the other. All the analyses are conducted separately in the 3-Digit industries. In order to ease the presentation of results, we

[9]Notice that our data banks do not allow to study the contribution of entry and exit. Hence our argument is limited to incumbents. Here incumbent means the presence in the data set in the two consecutive years over which the variations are calculated.

[10]The full set of results are available from the authors.

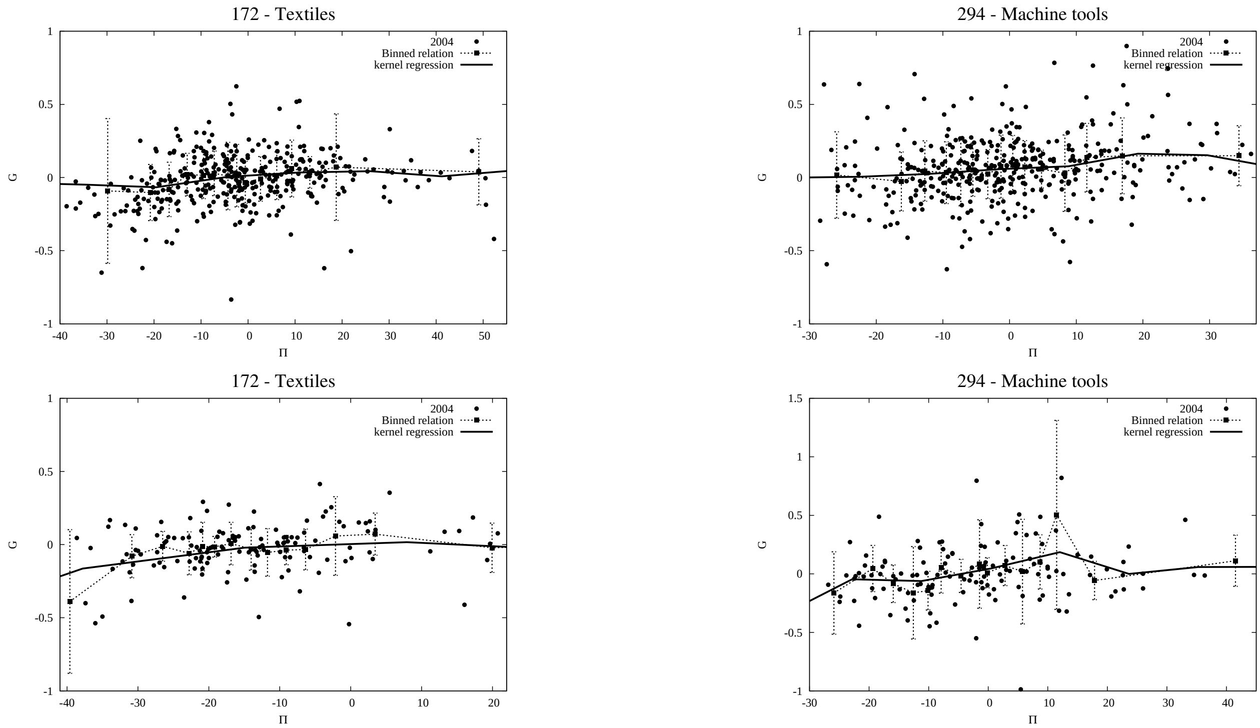

Figure 1: Productivity-Growth relationship in selected 3-Digit sectors - Binned statistics and kernel regression in 2004. Firm Productivities are normalised with annual sectoral averages: Italy (**Top panel**) vs. France (**Bottom panel**)

show graphs reporting estimates for 2004 on two sectors, Textiles (NACE 172) and Machine Tools (NACE 294), chosen because they are among the sectors with the highest number of observations. However the results emerge as time-invariant properties independent from sectoral characteristics.[11]

Consider first the link between productivity (Π) and growth of sales (G), presented in Figure 1. The clouds of points represent the scatter plot of the raw data for the couples (Π_i, G_i). The binned statistics are represented with dashed lines. The sample is divided in equipopulated bins and the average within-bin values of Π are plotted against the average of G computed in the same bin, together with 1-standard deviation error bar. The thick lines represent kernel regressions of the conditional expectation of Π given G.[12]

The evidence suggests a lack of any clear association between the variables. This applies to all sectors and to both countries. The clouds of points are quite dispersed and do not present any apparent shape. Further, notice that a flat line is a good first approximation connecting the pairs (average G, average Π) computed over the different productivity bins.[13] The impression is confirmed by kernel estimates, which yield basically flat regression lines, in all of the sectors under analysis. Increasing or decreasing patterns can be considered only as a minor deviation from the general pattern, limited to the extreme parts of the productivity

[11] Results on other sectors and years are available from the authors upon request.

[12] Computation of binned statistics is based on 15 equipopulated bins, while kernel estimates employ an Epanenchnikov kernel function. Conclusions do not depend from these particular choices.

[13] These pairs always fall within the confidence band represented by the 1-standard deviation vertical bars, suggesting that growth performance does not display any statistically significant difference in the different productivity bins.

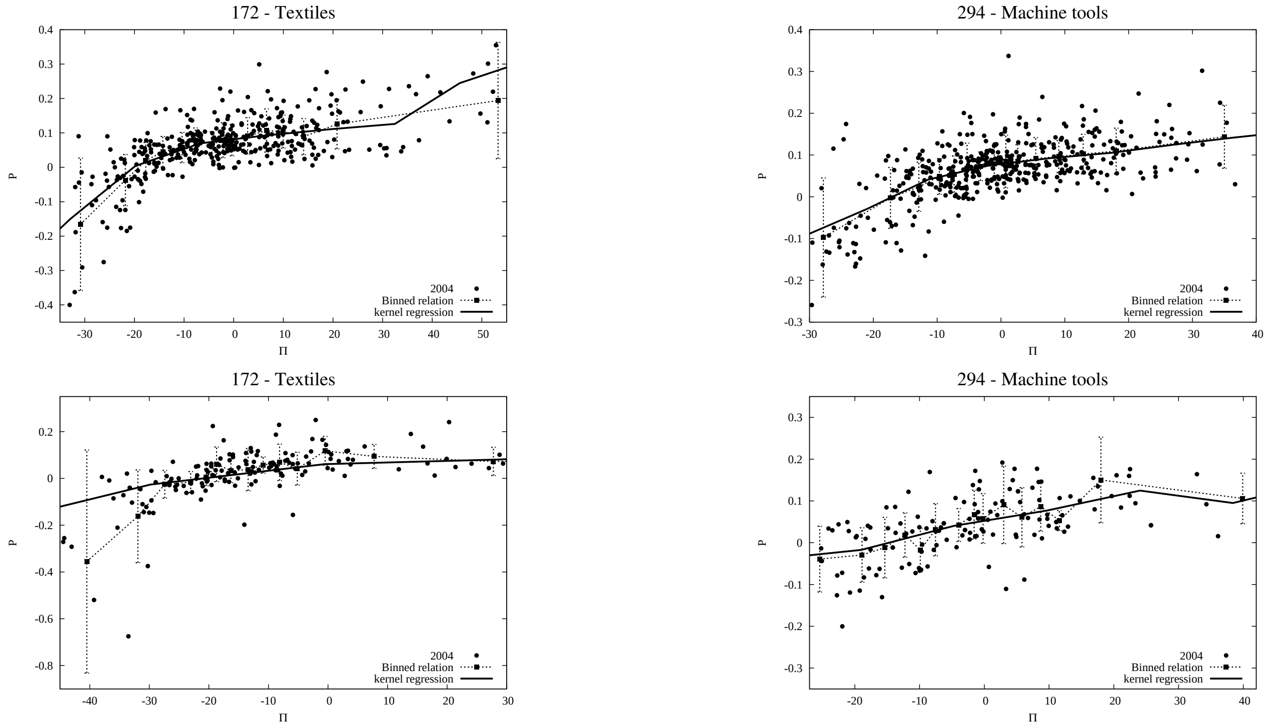

Figure 2: Productivity-Profitability relationship in selected 3-Digit sectors - Binned statistics and kernel regression in 2004. Firm Productivity is normalised with annual sectoral averages: Italy (**Top panel**) vs. France (**Bottom panel**)

distribution, where kernel estimates become less reliable due to lower number of observations.

The absence of a clear positive relationship between productivity levels and growth testifies against the existence of any strong selection dynamics among incumbent firms. This evidence confirms and extends a similar results on 2-digit Italian manufacturing sectors reported in Bottazzi et al. (2005b), suggesting that the result does not depend on disaggregation level. The question is whether this absence is due to the inability of firms to translate their technical advantages in internal resources, which can be in turn used for expanding their operations, or if a more abundant availability of resources does not translate automatically in an increased ability or willingness to grow. Some hints about this issue can be obtained by investigating how productivity and growth relate with firm profitability. Plots in Figure 2 show results concerning the productivity-profitability relation. As before, a simple scatter plot of the raw data (Π_i, P_i) is depicted with dots, while binned statistics (within-bin average values of Π vs. within-bin average of P with 1-standard deviation error bar) are in dashed lines, and kernel estimates of the conditional expectation of P given Π are reported as a thick line. The tendency displayed by the graphs is in this case revealing of a positive association between the variables. This is a clearcut result highlighted by both binned statistics and kernel regressions, which indeed show much steeper patterns as compared to the productivity-growth relations. Moreover, the relationship is steeper for those firms with relatively low values of productivity, and becomes weaker, yet still positive, as one moves towards higher productivity levels. This hints at the emergence of a peculiar non-linearity, already noted in Bottazzi et al. (2008) on a different sample of Italian firms. The result is more pronounced for Italian firms, and applies to all sectors. It is then clear that, at least on average, firms with higher productivity levels are characterized by higher profit margins.

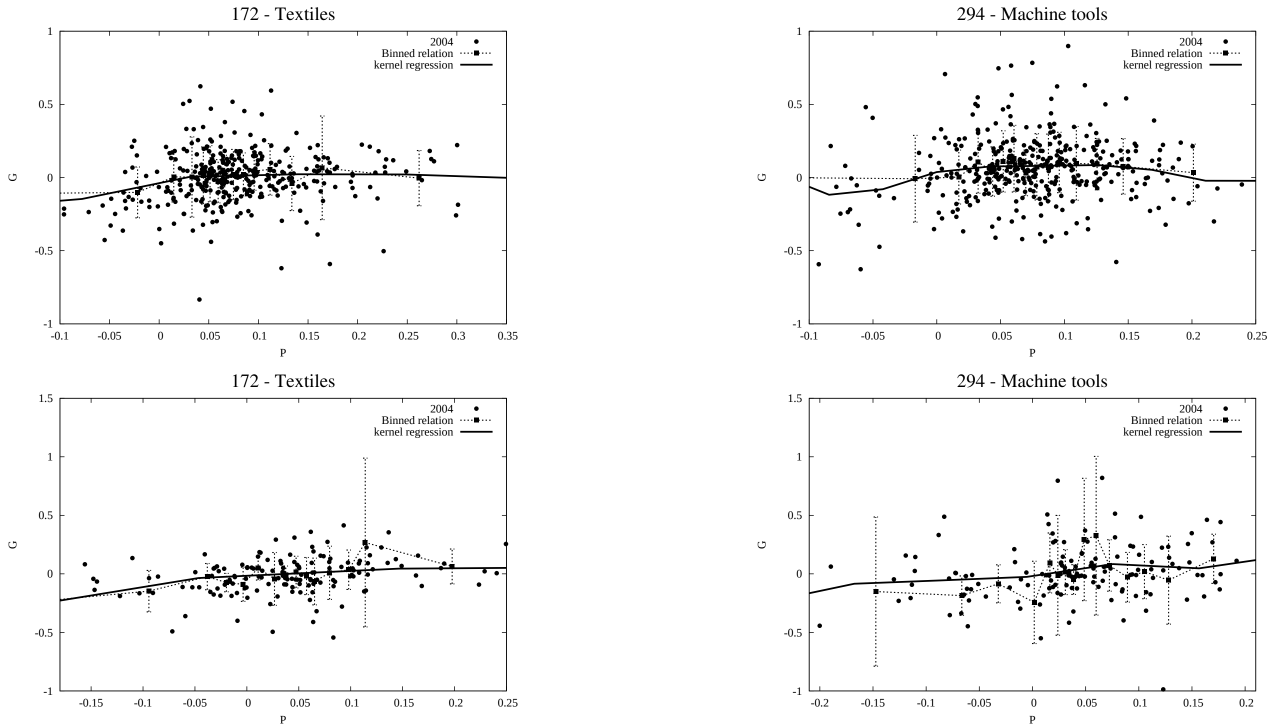

Figure 3: Profitability-Growth relationship in selected 3-Digit sectors - Binned statistics and kernel regression in 2004: Italy (**Top panel**) vs. France (**Bottom panel**)

Conversely, no evident pattern emerges in the relationship between growth and profitability, shown in Figure 3. Here the findings closely resemble what observed for the productivity-growth relationship. The clouds of points remain much dispersed, while both binned statistics and kernel smoothing allow to conclude that a flat line provides a good approximation of the data. Again, this applies to both countries and irrespective of the sectors considered.

Summarising, the relations linking productivity, profitability and growth seem considerably weaker than what one would have expected on the grounds of any simple view that market competition would lead to reallocation of production and market shares toward the more efficient and/or the more profitable firms. The productivity-profitability relationship seems indeed the only link displaying economic relevance in the data, whereas the relationships of growth with either productivity or profitability appear much weaker, if at all existent. The following section explores to what extent this picture survives if we control for the effect of firm specific unobserved variables, and analyse the unfolding of such relationships over time.

4 Panel analysis

The non parametric exercises presented in Section 3 look at the relation between productivity, profitability and growth comparing the values of these variables for all the firm belonging to one sector in one particular year. In this section we start investigating the same contemporaneous relationships but introducing a parametric specification which allows to exploit the panel structure of the data to control for possibly unobserved firm-specific factors. The basic regression specification is a bivariate model of the form

$$Y_{i,t} = c + \alpha X_{i,t} + u_i + \epsilon_{i,t} \quad , \tag{1}$$

where Y and X represent the pair of productivity-profitability-growth measures considered in the different regressions, while the term u_i is a firm-specific constant, modeling unobserved characteristics, and $\epsilon_{i,t}$ a standard *i.i.d.* error term. All the estimates are undertaken separately for each 3-Digit sector, adding a full set of year dummies and controlling for possible time effects common to all the firms in the same sector.

Notice that a sheer comparison of the estimated α across the different regressions is not very informative about the relative strength of the association between the pair of variables involved, since clearly the values of α depend on the scale (or unit of measurement) of the variables. The strength of association is better captured by the index

$$S^2_{Y,X} = \left(\hat{\alpha} \frac{\sigma_X}{\sigma_Y} \right)^2 , \qquad (2)$$

where $\hat{\alpha}$ is the fixed effects estimate of the coefficient in Equation 1 and σ_X and σ_Y represent the sample standard deviation of X and Y, respectively. Then $S^2_{Y,X}$ yields a measure of the fraction of the variance of Y which is explained by the variance of X. That is, it captures the explanatory power due to the economic regressor X alone, net of the contribution of annual dummies and unobserved heterogeneity. We shall compare its values with the canonical $R^2 = (1 - \frac{\sigma^2_\epsilon}{\sigma^2_Y})$ which gives a measure of the overall explanatory power of the model, including the contribution of annual dummies and unobserved heterogeneity. Notice however that in all our regressions the explanatory power associated with year dummies is negligible. Thus, the fraction of the R^2 which is not captured by $S^2_{Y,X}$ can be seen as a proxy for the explanatory power due to unobserved heterogeneity alone. Of course, given that the heterogeneity is assumed to be time invariant in panel models, the contribution of the u_i terms tend to be higher in specifications where the dependent Y display higher persistence over time. Indeed, to check this, we estimated a simple AR(1) model on each variable. The average of the coefficients obtained in the different sectors considered is 1.01 in the case of productivity, for both Italy and France; average coefficients obtained in the case of profitability equal 0.94 in Italy and 0.97 in France. The average AR(1) coefficients on growth are instead significantly lower, and equal 0.19 in Italy and 0.17 in France. These results are consistent with other studies, see Bottazzi et al. (2008), Coad et al. (2008) and the works cited therein.

For any instantiation of Equation 1 we run a series of robustness check performing augmented regressions including among the regressors proxies for ICT intensity, skill composition of the labour force and patterns of innovation, based on standard taxonomies used in international studies (see Pavitt, 1984, O'Mahony and Van Ark, 2003). Since the general pattern of results remains exactly the same we report here only the simplest specification. The fact that the distributions of estimated coefficients do not vary across taxonomy classes suggests that the possible impact of sector-specific technological and organizational characteristics on the relation studied here is negligible.

We start exploring the direct association of productivity with growth. The estimated equation is

$$G_{i,t} = c + \alpha \Pi_{i,t} + u_i + \epsilon_{i,t} \quad , \qquad (3)$$

where productivities are again normalised with the annual sectoral averages.

Table 4 shows coefficient estimates obtained for the sample of sectors available in the two countries, as well as the associated values of $S^2_{Y,X}$ and R^2. As a general result, we observe a clearcut pattern, with positive (and significant) estimates in practically all sectors, in both countries. Notice, however, that the strength of the relationship is actually very

		ITALY			FRANCE		
NACE	Sector	$\hat{\alpha}$	S^2_{YX}	R^2	$\hat{\alpha}$	S^2_{YX}	R^2
151	Production, process & preserv. of meat	0.0023*	0.0477	0.2185	—	—	—
155	Dairy products	0.0020*	0.0317	0.1490	—	—	—
158	Prod. of other food (bread, sugar, etc)	0.0011*	0.0272	0.2930	—	—	—
159	Beverages (alcoholic & not)	0.0022*	0.1098	0.1757	—	—	—
171	Preparation and spinning of textiles	0.0045*	0.0936	0.2561	0.0008*	0.0138	0.1828
172	Textiles weaving	0.0023*	0.0623	0.2916	0.0003*	0.0067	0.2297
175	Carpets, rugs and other textiles	0.0039*	0.2383	0.3585	0.0004*	0.0037	0.1876
177	Knitted and crocheted articles	0.0071*	0.2433	0.2913	—	—	—
182	Wearing apparel	0.0052*	0.1543	0.3269	0.0009*	0.0124	0.2291
193	Footwear	0.0086*	0.2048	0.2859	0.0069*	0.1232	0.2020
203	Wood products for construction	0.0066*	0.1564	0.2836	—	—	—
204	Wooden containers	—	—	—	0.0065*	0.1271	0.1912
211	Pulp, paper and paperboard	—	—	—	0.0015*	0.0446	0.1316
212	Articles of paper and paperboard	0.0021*	0.0632	0.2412	0.0027*	0.0415	0.1808
221	Publishing	0.0012*	0.0746	0.3028	0.0003*	0.0366	0.1909
222	Printing	0.0027*	0.1063	0.3688	0.0058*	0.1078	0.1856
241	Production of basic chemicals	0.0006*	0.0158	0.1255	0.0000	0.0006	0.1123
243	Paints, varnishes, inks & mastics	0.0015*	0.0290	0.1961	0.0043*	0.1529	0.2351
244	Pharma., med. chemicals, botanical prod	0.0012*	0.0310	0.3863	0.0001*	0.0055	0.1751
245	Soap and deterg & perfumes and toilet prep	—	—	—	0.0001*	0.0072	0.1536
246	Other chemical products	0.0023*	0.1166	0.3168	0.0005*	0.0253	0.1760
251	Rubber products	0.0026*	0.0532	0.2833	—	—	—
252	Plastic products	0.0032*	0.1200	0.2789	0.0017*	0.0302	0.1637
263	Ceramic goods for construction	0.0033*	0.1125	0.3327	—	—	—
266	Concrete, plaster and cement	0.0025*	0.0851	0.3158	0.0012*	0.0196	0.1745
267	Cutting, shaping and finishing of stone	0.0039*	0.2360	0.3045	—	—	—
275	Casting of metals	0.0051*	0.1436	0.2758	0.0086*	0.1545	0.2462
281	Structural metal products	0.0060*	0.1183	0.3131	0.0089*	0.1195	0.2087
283	Steam generators, except central heating	—	—	—	0.0039*	0.0417	0.1642
284	Forging, pressing, stamping, of metal	0.0059*	0.2009	0.2812	0.0058*	0.1054	0.2013
285	Treatment and coating of metals	0.0060*	0.1957	0.3556	0.0088*	0.2142	0.2261
286	Cutlery, tools and general hardware	0.0054*	0.2267	0.2850	—	—	—
287	Other fabricated metal products	0.0037*	0.0928	0.2719	0.0059*	0.1493	0.1717
291	Machinery for prod. & use of mech. power	0.0035*	0.0942	0.2823	0.0047*	0.1404	0.1874
292	Other general purpose machinery	0.0052*	0.1613	0.2626	0.0083*	0.1870	0.1884
293	Agricultural and forestry machinery	—	—	—	0.0082*	0.1646	0.2057
294	Machine tools	0.0062*	0.1525	0.3340	0.0089*	0.1781	0.3158
295	Other special purpose machinery	0.0061*	0.1553	0.2389	0.0075*	0.1582	0.2011
297	Domestic appliances not e/where class	0.0027*	0.0607	0.2552	—	—	—
311	Electric motors, generators and transform	0.0040*	0.1147	0.3973	0.0084*	0.1340	0.2377
312	Manuf. of electricity distrib, control equip	0.0046*	0.1059	0.3092	—	—	—
316	Electrical equipment not e/where class	0.0050*	0.1771	0.2849	—	—	—
321	Elect valves & tubes, other elect components	—	—	—	0.0069*	0.1725	0.2844
331	Medical & surgical equip, orthopedic appl	—	—	—	0.0043*	0.1152	0.2263
332	Measuring, checking, testing &navigat app.	—	—	—	0.0058*	0.1167	0.2557
333	Industrial process control equipment	—	—	—	0.0100*	0.2372	0.2616
343	Production of spare parts for cars	0.0043*	0.0845	0.2259	—	—	—
361	Furniture	0.0057*	0.1331	0.2826	0.0111*	0.2107	0.2576
362	Jewelry and related articles	0.0047*	0.0870	0.2231	—	—	—
366	Miscellaneous manufact. not e/where class	0.0043*	0.1590	0.3188	0.0000	0.0014	0.1503

Table 4: Contemporaneous relationship between Productivity and Growth – Fixed Effects estimates of Equation 3. Productivity is in deviation from annual sectoral average. *Coefficient significant at 5% confidence level.

weak. Comparisons between values of $S^2_{Y,X}$ and R^2 reveal indeed that only below a quarter of explained variance comes from productivity "alone", while the contribution of unobserved heterogeneity is always much larger. Overall, while the productivity variable has the expected sign, its contribution to the explanation of the variance in growth rates is modest: always below 5% and most often below 3%. Putting it another way, even if industry-wide forces driving toward selection/reallocation of resources in favour of more efficient firms are always present, their strength is extremely low, at least in the short term.

We then move a step further and ask whether selection operates via profitability. We again consider the two relationships capturing the association of productivity with profitability, on the one hand, and that of profitability with growth, on the other. Results in Table 5 present the estimates of the regression model

$$P_{i,t} = c + \alpha \Pi_{i,t} + u_i + \epsilon_{i,t} \quad . \tag{4}$$

where productivity is again measured in relative terms.

In general the association between the two variables is positive and significant, in both countries, irrespective of the sectors. Moreover, the relationship stands out as considerably stronger as compared to the results obtained for the productivity-growth relation. The total explained variance is higher than before (cfr. R^2 greater than 60 or 70% in most cases, as expected due to higher persistence of the dependent variable), and we also observe a significant increase in the estimates of $S^2_{Y,X}$, which display values greater than 35% in the vast majority of the sectors, with peaks above 60%. Thus, the explanatory power of relative productivity is comparable to that stemming from firm-specific factors capturing unobserved heterogeneity: more efficient firms do tend to be more profitable.

Finally, we explore the profitability-growth relationship. Here the issue is whether gross profits spur growth, which we capture through the regression model

$$G_{i,t} = c + \alpha P_{i,t} + u_i + \epsilon_{i,t} \quad . \tag{5}$$

The estimates, reported in Table 6, provide a picture which is quite similar to that offered by the productivity-growth regressions. The estimated coefficients are positive and significant, but the values of $S^2_{Y,X}$ and R^2 are once again revealing that the relationship is weak and almost entirely driven by the firm-specific components u_i. With R^2's in the range of 0.2 to 0.4 and $S^2_{Y,X}$ roughly around 0.1 (indeed lower in most sectors), the profitability variable accounts at best for 2 or 3 percentage points of the variance in growth rates. The relationship is generally there, but appears to be extremely weak.

An overall reading of the findings yields conclusions which closely agree with the impression drawn from previous non parametric investigations. The (contemporaneous) relations between firm growth, on the one hand, and both productivity and profitability, on the other, appear to be rather weak. This, in turn, witnesses for relatively weak selection forces at work, at least in the short term, neither through a productivity effect – efficiency spurring differential growth – nor via a profitability one – higher margins entailing greater cash flows and through that greater possibilities of expansion. Greater degrees of efficiency – as proxied by higher labour productivity – are indeed robustly associated with higher profitability, but the latter does not display any straightforward association with growth.

As compared to the non parametric analysis of the previous section, panel regressions allow to disentangle the importance of idiosyncratic (firm-specific) unobserved factors. In fact, the regression modeling profitability as dependent on productivity stands out as the

		ITALY			FRANCE		
NACE	Sector	$\hat{\alpha}$	S^2_{YX}	R^2	$\hat{\alpha}$	S^2_{YX}	R^2
151	Production, process & preserv. of meat	0.0019*	0.3285	0.6392	—	—	—
155	Dairy products	0.0019*	0.2706	0.4214	—	—	—
158	Prod. of other food (bread, sugar, etc)	0.0019*	0.4542	0.8100	—	—	—
159	Beverages (alcoholic & not)	0.0020*	0.3880	0.4465	—	—	—
171	Preparation and spinning of textiles	0.0033*	0.3358	0.7226	0.0005*	0.0614	0.4599
172	Textiles weaving	0.0023*	0.3378	0.7294	0.0002*	0.0284	0.5198
175	Carpets, rugs and other textiles	0.0031*	0.5200	0.7122	0.0003*	0.0251	0.5246
177	Knitted and crocheted articles	0.0041*	0.3711	0.6082	—	—	—
182	Wearing apparel	0.0033*	0.0570	0.4543	0.0004*	0.0377	0.4924
193	Footwear	0.0043*	0.3193	0.5284	0.0029*	0.3082	0.6056
203	Wood products for construction	0.0045*	0.5588	0.6670	—	—	—
204	Wooden containers	—	—	—	0.0038*	0.6091	0.7399
211	Pulp, paper and paperboard	—	—	—	0.0024*	0.7096	0.8433
212	Articles of paper and paperboard	0.0024*	0.5459	0.7218	0.0021*	0.2992	0.6736
221	Publishing	0.0018*	0.3503	0.6948	0.0000*	0.0045	0.6697
222	Printing	0.0026*	0.3479	0.6672	0.0027*	0.3915	0.6259
241	Production of basic chemicals	0.0006*	0.1053	0.5202	0.0000*	0.0083	0.7204
243	Paints, varnishes, inks & mastics	0.0020*	0.5437	0.8200	0.0029*	0.6054	0.8231
244	Pharma., med. chemicals, botanical prod	0.0011*	0.2682	0.5029	0.0001*	0.0288	0.7245
245	Soap and deterg & perfumes and toilet prep	—	—	—	0.0001*	0.0645	0.5830
246	Other chemical products	0.0019*	0.3325	0.4788	0.0003*	0.0594	0.5786
251	Rubber products	0.0030*	0.4570	0.7896	—	—	—
252	Plastic products	0.0023*	0.3510	0.7132	0.0011*	0.1730	0.5931
263	Ceramic goods for construction	0.0031*	0.4818	0.7029	—	—	—
266	Concrete, plaster and cement	0.0007*	0.0584	0.6106	0.0007*	0.0962	0.6049
267	Cutting, shaping and finishing of stone	0.0020*	0.3579	0.6700	—	—	—
275	Casting of metals	0.0025*	0.3003	0.6580	0.0064*	0.7176	0.7554
281	Structural metal products	0.0033*	0.3410	0.6435	0.0042*	0.6122	0.7367
283	Steam generators, except central heating	—	—	—	0.0014*	0.1058	0.4973
284	Forging, pressing, stamping, of metal	0.0034*	0.4029	0.5412	0.0033*	0.3878	0.6820
285	Treatment and coating of metals	0.0040*	0.4132	0.6952	0.0052*	0.6946	0.7252
286	Cutlery, tools and general hardware	0.0035*	0.3188	0.6038	—	—	—
287	Other fabricated metal products	0.0031*	0.4788	0.7096	0.0033*	0.6044	0.7433
291	Machinery for prod. & use of mech. power	0.0031*	0.3929	0.6945	0.0029*	0.4185	0.7106
292	Other general purpose machinery	0.0029*	0.4341	0.7503	0.0044*	0.6611	0.7184
293	Agricultural and forestry machinery	—	—	—	0.0042*	0.6291	0.6874
294	Machine tools	0.0024*	0.3433	0.6764	0.0049*	0.6009	0.7178
295	Other special purpose machinery	0.0035*	0.5164	0.6621	0.0042*	0.5357	0.6842
297	Domestic appliances not e/where class	0.0023*	0.4152	0.7349	—	—	—
311	Electric motors, generators and transform	0.0029*	0.4990	0.7598	0.0051*	0.5085	0.7803
312	Manuf. of electricity distrib, control equip	0.0033*	0.3516	0.7454	—	—	—
316	Electrical equipment not e/where class	0.0024*	0.3247	0.7587	—	—	—
321	Elect valves & tubes, other elect components	—	—	—	0.0040*	0.1573	0.9018
331	Medical & surgical equip, orthopedic appl	—	—	—	0.0036*	0.4046	0.5873
332	Measuring, checking, testing &navigat app.	—	—	—	0.0031*	0.3280	0.6542
333	Industrial process control equipment	—	—	—	0.0036*	0.4585	0.6289
343	Production of spare parts for cars	0.0139*	0.0060	0.1296	—	—	—
361	Furniture	0.0035*	0.4313	0.6371	0.0057*	0.5827	0.7026
362	Jewelry and related articles	0.0019*	0.2132	0.5142	—	—	—
366	Miscellaneous manufact. not e/where class	0.0032*	0.5358	0.6848	0.0000*	0.0043	0.5290

Table 5: Contemporaneous relationship between Productivity and Profitability – Fixed Effects estimates of Equation 4. Productivity is in deviation from annual sectoral average. *Coefficient significant at 5% confidence level.

		ITALY			FRANCE		
NACE	Sector	$\hat{\alpha}$	S^2_{YX}	R^2	$\hat{\alpha}$	S^2_{YX}	R^2
151	Production, process & preserv. of meat	1.2511*	0.1754	0.2901	—	—	—
155	Dairy products	1.7550*	0.3299	0.3728	—	—	—
158	Prod. of other food (bread, sugar, etc)	0.4858*	0.0364	0.3067	—	—	—
159	Beverages (alcoholic & not)	1.2601*	0.3196	0.3561	—	—	—
171	Preparation and spinning of textiles	0.6340*	0.0545	0.2449	0.6025*	0.0783	0.2405
172	Textiles weaving	0.5265*	0.0478	0.2943	0.9537*	0.1006	0.2833
175	Carpets, rugs and other textiles	0.4540*	0.0553	0.3291	1.0098*	0.0935	0.2312
177	Knitted and crocheted articles	0.7578*	0.1472	0.3055	—	—	—
182	Wearing apparel	0.1096*	0.0147	0.3138	0.5863*	0.0784	0.2480
193	Footwear	0.8679*	0.1056	0.2997	1.3132*	0.1247	0.2242
203	Wood products for construction	0.5279*	0.0359	0.2892	—	—	—
204	Wooden containers	—	—	—	0.7712*	0.0491	0.1810
211	Pulp, paper and paperboard	—	—	—	0.3428*	0.0226	0.1209
212	Articles of paper and paperboard	0.7236*	0.0747	0.2582	0.6636*	0.0395	0.1812
221	Publishing	0.1706*	0.0121	0.2939	0.0472*	0.0069	0.1739
222	Printing	0.6643*	0.1376	0.3542	0.7094*	0.0433	0.1608
241	Production of basic chemicals	1.4128*	0.3470	0.3491	0.3307*	0.0211	0.1210
243	Paints, varnishes, inks & mastics	0.9854*	0.0653	0.2206	0.8216*	0.0776	0.2157
244	Pharma., med. chemicals, botanical prod	1.0134*	0.1213	0.4519	0.3168*	0.0309	0.2023
245	Soap and deterg & perfumes and toilet prep	—	—	—	0.8435*	0.0764	0.1771
246	Other chemical products	0.8846*	0.2527	0.4737	0.5822*	0.0592	0.1987
251	Rubber products	0.2447*	0.0095	0.2852	—	—	—
252	Plastic products	0.8717*	0.1263	0.2904	0.6238*	0.0342	0.1697
263	Ceramic goods for construction	0.3509*	0.0240	0.3070	—	—	—
266	Concrete, plaster and cement	0.4693*	0.0200	0.2790	0.6476*	0.0345	0.1818
267	Cutting, shaping and finishing of stone	0.5609*	0.0563	0.2697	—	—	—
275	Casting of metals	0.8911*	0.1018	0.2873	0.8818*	0.0912	0.2396
281	Structural metal products	0.8370*	0.0684	0.3142	1.1442*	0.0608	0.1959
283	Steam generators, except central heating	—	—	—	1.1410*	0.0764	0.1828
284	Forging, pressing, stamping, of metal	0.8923*	0.1239	0.2989	0.8676*	0.0762	0.1907
285	Treatment and coating of metals	0.6561*	0.0911	0.3456	0.8226*	0.0917	0.2065
286	Cutlery, tools and general hardware	0.3338*	0.0342	0.2474	—	—	—
287	Other fabricated metal products	0.9017*	0.1189	0.3106	0.7052*	0.0367	0.1452
291	Machinery for prod. & use of mech. power	0.8954*	0.1487	0.3153	0.6800*	0.1288	0.2317
292	Other general purpose machinery	0.8271*	0.0701	0.2553	1.1243*	0.1092	0.1737
293	Agricultural and forestry machinery	—	—	—	1.1479*	0.1323	0.2132
294	Machine tools	0.6543*	0.0382	0.2998	1.1260*	0.1213	0.3149
295	Other special purpose machinery	0.9698*	0.0828	0.2307	1.1159*	0.1225	0.1978
297	Domestic appliances not e/where class	0.3325*	0.0103	0.2403	—	—	—
311	Electric motors, generators and transform	0.7281*	0.0628	0.3965	1.0091*	0.1042	0.2438
312	Manuf. of electricity distrib, control equip	0.4637*	0.0390	0.2864	—	—	—
316	Electrical equipment not e/where class	0.7113*	0.0557	0.2767	—	—	—
321	Elect valves & tubes, other elect components	—	—	—	0.0103	0.0020	0.2416
331	Medical & surgical equip, orthopedic appl	—	—	—	0.3024*	0.0378	0.2159
332	Measuring, checking, testing &navigat app.	—	—	—	0.3180*	0.0708	0.2670
333	Industrial process control equipment	—	—	—	0.5938*	0.0864	0.2233
343	Production of spare parts for cars	0.0306*	0.1770	0.3518	—	—	—
361	Furniture	0.6915*	0.0546	0.2846	0.9761*	0.0970	0.2394
362	Jewelry and related articles	1.5110*	0.1609	0.2871	—	—	—
366	Miscellaneous manufact. not e/where class	0.7875*	0.0958	0.3261	1.0976*	0.1007	0.1989

Table 6: Contemporaneous relationship between Profitability and Growth – Fixed Effects estimates of Equation 5. *Coefficient significant at 5% confidence level.

only case where the statistical relevance of the economic regressor is comparable to the explanatory power of unaccounted sources of micro heterogeneity. Conversely, the relevance of systematic, economically interpretable regressors is weak in both the productivity-growth and the profitability-growth relationships, where a good deal of the explained variance rests upon unobserved fixed effects.

Of course, contemporaneous relations capture linkages only over very short run, while it is indeed reasonable that the relationships we are investigating have an essentially dynamic and structural nature. Hence, one should consider the workings of the relationships over a longer time scale, allowing for the effect of each variable on the others to take some time to emerge. In this perspective we now investigate panel estimates of the links between average values of productivity, profitability and growth records computed over multi-year subperiods.

Indicating with s the period and with T_s the number of years spanned by each period, the time series average of the variables are defined over three periods p_1, p_2 and p_3, as follows

$$\bar{Z}_{i,s} = \frac{1}{T_s} \sum_{t \in s} Z_{i,t} \quad \text{s} \in \{\text{p}_1, \text{p}_2, \text{p}_3\} \quad \text{Z} \in \{ \Pi, \text{P}, \text{G} \} \quad . \tag{6}$$

Then, we set p_1=1992-1995, p_2 = 1996-1999 and p_3 = 2000-2004 for Italian data, while p_1 = 1990-1994, p_2 = 1995-1999 and p_3 = 2000-2004 for the French data.[14]

This leaves us with a panel of three periods, which can be used to replicate the same kind of analysis explored above. The baseline empirical model thus becomes

$$\bar{Y}_{i,s} = c + \alpha \bar{X}_{i,s} + u_i + \epsilon_{i,s} \quad , \tag{7}$$

where Y and X represent the pair of economic performance considered in each pairwise regression, and u_i is again a firm-specific constant absorbing unobserved characteristics. For consistency with previous analysis, we present Fixed Effects estimates obtained separately for each 3-Digit sector, also including time (period) dummies. As compared to the previous models where we take yearly values, averaging over time is likely to entail a reduction in the intertemporal variability of the variables, and thus we expect an increase in the R^2's, due to an increased explanatory power of time invariant heterogeneity. The question is whether we can confirm the relatively weak explanatory power of the economic regressors.[15]

Table 7 shows results for the specification exploring the link between average productivity and average growth

$$\bar{G}_{i,s} = c + \alpha \bar{\Pi}_{i,s} + u_i + \epsilon_{i,s} \quad . \tag{8}$$

The main conclusions are consistent with results drawn from contemporaneous yearly regressions. The weakness of the association between the variables is even more apparent, if one considers that the estimates of α turn out not statistically different from zero in about a half of the sectors.[16] The expected increase in the overall explained variance (R^2 generally equals

[14]Previous analysis on similar database in Bottazzi et al. (2005a) show that a period of $4-5$ years is enough to smooth out fluctuations in production structure due to structural adjustments.

[15]An alternative strategy looking at time effects would have been to still consider yearly values of the variables and include lagged regressors, experimenting with different orders of lag. However, taking multi-year averages is preferable, as it is likely to reduce possible biases due to measurement errors in yearly figures. Anyhow, we did estimate models exploring the effect of one-year lagged regressors, but results (available upon request) do not depart form the patterns stemming from the contemporaneous analyses above.

[16]Also notice two negative values of α, one in Italy (sector 158) and one in France (sector 244).

		ITALY			FRANCE		
NACE	Sector	$\hat{\alpha}$	S^2_{YX}	R^2	$\hat{\alpha}$	S^2_{YX}	R^2
151	Production, process & preserv. of meat	0.0014*	0.0379	0.7211	—	—	—
155	Dairy products	-0.0003	0.0018	0.6144	—	—	—
158	Prod. of other food (bread, sugar, etc)	-0.0014*	0.0280	0.6207	—	—	—
159	Beverages (alcoholic & not)	0.0005	0.0108	0.6031	—	—	—
171	Preparation and spinning of textiles	0.0005	0.0012	0.4750	0.0013*	0.0742	0.6967
172	Textiles weaving	0.0008	0.0081	0.6141	0.0009*	0.0336	0.8376
175	Carpets, rugs and other textiles	0.0024*	0.1389	0.6029	0.0000	0.0002	0.8296
177	Knitted and crocheted articles	0.0022*	0.0393	0.7248	—	—	—
182	Wearing apparel	0.0021*	0.0325	0.7179	0.0003*	0.0013	0.7635
193	Footwear	0.0053*	0.0652	0.6343	0.0016	0.0090	0.7432
203	Wood products for construction	0.0022	0.0213	0.6586	—	—	—
204	Wooden containers	—	—	—	-0.0005	0.0015	0.7568
211	Pulp, paper and paperboard	—	—	—	-0.0006	0.0266	0.5063
212	Articles of paper and paperboard	-0.0001	0.0001	0.6265	0.0011*	0.0108	0.7532
221	Publishing	0.0010*	0.0491	0.6984	0.0001	0.0057	0.7072
222	Printing	0.0026*	0.0667	0.6038	0.0014*	0.0114	0.7180
241	Production of basic chemicals	0.0003	0.0104	0.5634	0.0001	0.0040	0.5376
243	Paints, varnishes, inks & mastics	-0.0031	0.0745	0.5441	0.0003	0.0016	0.8201
244	Pharma., med. chemicals, botanical prod	0.0007*	0.0157	0.8952	-0.0007*	0.1425	0.5503
245	Soap and deterg & perfumes and toilet prep	—	—	—	0.0000	0.0001	0.6337
246	Other chemical products	0.0002	0.0008	0.5985	0.0001	0.0026	0.6648
251	Rubber products	0.0009	0.0094	0.6536	—	—	—
252	Plastic products	0.0015*	0.0333	0.6604	0.0003	0.0012	0.6909
263	Ceramic goods for construction	0.0030*	0.1226	0.6484	—	—	—
266	Concrete, plaster and cement	0.0011*	0.0118	0.6197	0.0018*	0.0502	0.7080
267	Cutting, shaping and finishing of stone	0.0020*	0.0742	0.6633	—	—	—
275	Casting of metals	0.0024*	0.0325	0.5464	0.0010	0.0033	0.7017
281	Structural metal products	0.0024*	0.0213	0.7133	0.0012	0.0029	0.6875
283	Steam generators, except central heating	—	—	—	0.0010	0.0039	0.7206
284	Forging, pressing, stamping, of metal	0.0026*	0.0621	0.5928	0.0020*	0.0184	0.6362
285	Treatment and coating of metals	0.0040*	0.0902	0.7124	0.0035*	0.0521	0.6279
286	Cutlery, tools and general hardware	0.0002	0.0003	0.6131	—	—	—
287	Other fabricated metal products	0.0019*	0.0332	0.6663	-0.0007	0.0041	0.6469
291	Machinery for prod. & use of mech. power	0.0011*	0.0148	0.6681	-0.0000	0.0000	0.5974
292	Other general purpose machinery	0.0024*	0.0521	0.6547	0.0031*	0.0553	0.6684
293	Agricultural and forestry machinery	—	—	—	0.0027*	0.0382	0.6699
294	Machine tools	0.0042*	0.1308	0.7345	0.0036*	0.0416	0.8276
295	Other special purpose machinery	0.0018*	0.0180	0.6049	0.0025*	0.0334	0.7190
297	Domestic appliances not e/where class	-0.0009	0.0091	0.7017	—	—	—
311	Electric motors, generators and transform	0.0014	0.0160	0.7934	0.0031	0.0204	0.6661
312	Manuf. of electricity distrib, control equip	0.0001	0.0001	0.7530	—	—	—
316	Electrical equipment not e/where class	0.0043*	0.1525	0.6848	—	—	—
321	Elect valves & tubes, other elect components	—	—	—	0.0015*	0.0121	0.7629
331	Medical & surgical equip, orthopedic appl	—	—	—	0.0007	0.0041	0.7614
332	Measuring, checking, testing &navigat app.	—	—	—	0.0018*	0.0121	0.7553
333	Industrial process control equipment	—	—	—	0.0047*	0.0786	0.7926
343	Production of spare parts for cars	0.0046*	0.0759	0.2681	—	—	—
361	Furniture	0.0014*	0.0111	0.6036	0.0035*	0.0268	0.7052
362	Jewelry and related articles	0.0011	0.0115	0.6238	—	—	—
366	Miscellaneous manufact. not e/where class	0.0010	0.0120	0.6372	0.0000	0.0006	0.6974

Table 7: Multi-year averages: Productivity and Growth – Fixed Effects estimates of Equation 8. *Coefficient significant at 5% confidence level.

		ITALY			FRANCE		
NACE	Sector	$\hat{\alpha}$	S^2_{YX}	R^2	$\hat{\alpha}$	S^2_{YX}	R^2
151	Production, process & preserv. of meat	0.0019*	0.3053	0.8893	—	—	—
155	Dairy products	0.0015*	0.2923	0.7367	—	—	—
158	Prod. of other food (bread, sugar, etc)	0.0022*	0.4965	0.9243	—	—	—
159	Beverages (alcoholic & not)	0.0020*	0.5558	0.7913	—	—	—
171	Preparation and spinning of textiles	0.0034*	0.3374	0.8690	0.0004*	0.0243	0.6152
172	Textiles weaving	0.0024*	0.3268	0.8772	0.0005*	0.0921	0.7699
175	Carpets, rugs and other textiles	0.0031*	0.4643	0.8174	0.0001*	0.0071	0.7631
177	Knitted and crocheted articles	0.0029*	0.2036	0.7825	—	—	—
182	Wearing apparel	0.0032	0.0515	0.7163	0.0005*	0.0228	0.7801
193	Footwear	0.0034*	0.1362	0.7146	0.0026*	0.2193	0.8072
203	Wood products for construction	0.0040*	0.4101	0.8417	—	—	—
204	Wooden containers	—	—	—	0.0035*	0.5340	0.8373
211	Pulp, paper and paperboard	—	—	—	0.0025*	0.6318	0.8942
212	Articles of paper and paperboard	0.0020*	0.4259	0.8906	0.0029*	0.4783	0.8474
221	Publishing	0.0022*	0.4649	0.8895	0.0000*	0.0028	0.8663
222	Printing	0.0027*	0.3654	0.8331	0.0025*	0.5028	0.8311
241	Production of basic chemicals	0.0008*	0.1287	0.8820	0.0002	0.0018	0.3261
243	Paints, varnishes, inks & mastics	0.0020*	0.3350	0.9589	0.0028*	0.5795	0.8984
244	Pharma., med. chemicals, botanical prod	0.0006*	0.1142	0.6978	0.2190*	0.2741	0.3997
245	Soap and deterg & perfumes and toilet prep	—	—	—	0.0001*	0.0341	0.8018
246	Other chemical products	0.0019*	0.4896	0.7408	0.0002*	0.0174	0.8443
251	Rubber products	0.0030*	0.4475	0.9004	—	—	—
252	Plastic products	0.0020*	0.2614	0.8723	0.0006*	0.0064	0.9676
263	Ceramic goods for construction	0.0026*	0.3370	0.8280	—	—	—
266	Concrete, plaster and cement	0.0015*	0.1616	0.8564	0.0007*	0.0685	0.8323
267	Cutting, shaping and finishing of stone	0.0015*	0.1808	0.8133	—	—	—
275	Casting of metals	0.0033*	0.4852	0.8533	0.0069*	0.8578	0.8904
281	Structural metal products	0.0036*	0.3468	0.8640	0.0040*	0.5932	0.8685
283	Steam generators, except central heating	—	—	—	0.0038*	0.6100	0.7997
284	Forging, pressing, stamping, of metal	0.0032*	0.4178	0.7814	0.0032*	0.3218	0.8829
285	Treatment and coating of metals	0.0050*	0.6199	0.8630	0.0049*	0.6747	0.8225
286	Cutlery, tools and general hardware	0.0037*	0.3810	0.8407	—	—	—
287	Other fabricated metal products	0.0037*	0.5749	0.8602	0.0034*	0.6583	0.8766
291	Machinery for prod. & use of mech. power	0.0040*	0.6019	0.8118	0.0027*	0.2650	0.7631
292	Other general purpose machinery	0.0026*	0.2514	0.9167	0.0043*	0.6323	0.8297
293	Agricultural and forestry machinery	—	—	—	0.0034*	0.3937	0.8940
294	Machine tools	0.0031*	0.5748	0.8658	0.0055*	0.2128	0.9644
295	Other special purpose machinery	0.0032*	0.4399	0.8565	0.0044*	0.5732	0.8632
297	Domestic appliances not e/where class	0.0022*	0.4149	0.8509	—	—	—
311	Electric motors, generators and transform	0.0032*	0.6548	0.8547	0.0053*	0.4966	0.9021
312	Manuf. of electricity distrib, control equip	0.0037*	0.6102	0.9252	—	—	—
316	Electrical equipment not e/where class	0.0026*	0.4285	0.9064	—	—	—
321	Elect valves & tubes, other elect components	—	—	—	0.0027*	0.0020	0.9964
331	Medical & surgical equip, orthopedic appl	—	—	—	0.0064*	0.4940	0.7187
332	Measuring, checking, testing &navigat app.	—	—	—	0.0049*	0.1125	0.4614
333	Industrial process control equipment	—	—	—	0.0046*	0.6510	0.7722
343	Production of spare parts for cars	0.0204	0.0162	0.3375	—	—	—
361	Furniture	0.0028*	0.2652	0.8346	0.0054*	0.5184	0.8755
362	Jewelry and related articles	0.0031*	0.4965	0.7477	—	—	—
366	Miscellaneous manufact. not e/where class	0.0036*	0.5801	0.8253	0.0000	0.0034	0.7306

Table 8: Multi-year averages: Productivity and Profitability – Fixed Effects estimates of Equation 9. *Coefficient significant at 5% confidence level.

		ITALY			FRANCE		
NACE	Sector	$\hat{\alpha}$	S^2_{YX}	R^2	$\hat{\alpha}$	S^2_{YX}	R^2
151	Production, process & preserv. of meat	0.3948*	0.0308	0.7203	—	—	—
155	Dairy products	-0.4148*	0.0363	0.6239	—	—	—
158	Prod. of other food (bread, sugar, etc)	0.2372*	0.0071	0.6193	—	—	—
159	Beverages (alcoholic & not)	-0.7192*	0.1357	0.6456	—	—	—
171	Preparation and spinning of textiles	-0.2303	0.0083	0.4756	0.3702*	0.0384	0.7151
172	Textiles weaving	0.3926*	0.0329	0.6280	0.7113*	0.0613	0.8430
175	Carpets, rugs and other textiles	0.3471*	0.0494	0.5968	-0.0523	0.0010	0.8278
177	Knitted and crocheted articles	0.2192*	0.0220	0.7266	—	—	—
182	Wearing apparel	0.0394	0.0016	0.7160	0.4194*	0.0729	0.7657
193	Footwear	0.2886*	0.0116	0.6312	1.0002*	0.1088	0.7641
203	Wood products for construction	0.5587*	0.0441	0.6611	—	—	—
204	Wooden containers	—	—	—	0.4894*	0.0377	0.7660
211	Pulp, paper and paperboard	—	—	—	-0.3155*	0.0620	0.5026
212	Articles of paper and paperboard	0.9324*	0.1185	0.6474	0.4748*	0.0319	0.7591
221	Publishing	0.2346*	0.0218	0.6921	0.0106*	0.0041	0.7039
222	Printing	0.6338*	0.0645	0.6076	0.4015*	0.0206	0.7200
241	Production of basic chemicals	-0.0145	0.0001	0.5842	-0.0367*	0.0368	0.5546
243	Paints, varnishes, inks & mastics	1.4104*	0.0641	0.5525	0.3651*	0.0225	0.8253
244	Pharma., med. chemicals, botanical prod	0.1661*	0.0036	0.8920	-0.0032*	0.4476	0.8358
245	Soap and deterg & perfumes and toilet prep	—	—	—	0.5852*	0.0577	0.6459
246	Other chemical products	1.6332*	0.3780	0.7114	0.4802*	0.0487	0.6735
251	Rubber products	0.4371*	0.0413	0.6836	—	—	—
252	Plastic products	0.2268*	0.0106	0.6574	0.1979*	0.0354	0.6892
263	Ceramic goods for construction	0.2111	0.0104	0.6237	—	—	—
266	Concrete, plaster and cement	0.0801	0.0007	0.6338	0.2569	0.0087	0.7058
267	Cutting, shaping and finishing of stone	0.5938*	0.1021	0.6833	—	—	—
275	Casting of metals	-0.0803	0.0008	0.5501	0.2740	0.0113	0.7033
281	Structural metal products	0.2752*	0.0085	0.7121	0.6319*	0.0212	0.6911
283	Steam generators, except central heating	—	—	—	0.6321*	0.0339	0.7245
284	Forging, pressing, stamping, of metal	-0.2829*	0.0186	0.5877	0.4614*	0.0311	0.6384
285	Treatment and coating of metals	0.7119*	0.1100	0.7277	0.4731*	0.0391	0.6252
286	Cutlery, tools and general hardware	0.5823*	0.1005	0.6463	—	—	—
287	Other fabricated metal products	0.5104*	0.0445	0.6714	0.1657	0.0041	0.6473
291	Machinery for prod. & use of mech. power	0.4656*	0.0540	0.6779	0.3726*	0.0372	0.6075
292	Other general purpose machinery	0.4216*	0.0250	0.6529	0.4563*	0.0361	0.6488
293	Agricultural and forestry machinery	—	—	—	0.9689*	0.1485	0.6935
294	Machine tools	0.6531*	0.0500	0.7286	0.6818*	0.2249	0.8328
295	Other special purpose machinery	0.3336*	0.0128	0.6067	0.2847*	0.0155	0.7142
297	Domestic appliances not e/where class	-0.7356*	0.0723	0.7156	—	—	—
311	Electric motors, generators and transform	0.5501*	0.0387	0.8035	0.2731*	0.0094	0.6663
312	Manuf. of electricity distrib, control equip	-0.0082	0.0000	0.7418	—	—	—
316	Electrical equipment not e/where class	0.4452*	0.0280	0.6755	—	—	—
321	Elect valves & tubes, other elect components	—	—	—	-0.1733*	0.6315	0.7463
331	Medical & surgical equip, orthopedic appl	—	—	—	0.0780	0.0050	0.7624
332	Measuring, checking, testing &navigat app.	—	—	—	0.2990*	0.0790	0.7981
333	Industrial process control equipment	—	—	—	0.4544*	0.1281	0.8069
343	Production of spare parts for cars	0.0760*	0.6714	0.7043	—	—	—
361	Furniture	0.3311*	0.0141	0.6055	0.6203*	0.0523	0.7138
362	Jewelry and related articles	0.2261	0.0079	0.6269	—	—	—
366	Miscellaneous manufact. not e/where class	0.5076*	0.0585	0.6568	0.7886	0.1015	0.7206

Table 9: Multi-year averages: Profitability and Growth – Fixed Effects estimates of Equation 10. *Coefficient significant at 5% confidence level.

60-70%), is entirely due to the increased explanatory power of the firm specific constants u_i, while the contribution attributable to average productivity is negligible (cfr. very small $S^2_{Y,X}$).

Table 8 reports results concerning the pairwise regressions between average productivity and average profitability

$$\bar{P}_{i,s} = c + \alpha\bar{\Pi}_{i,s} + u_i + \epsilon_{i,s} \quad . \tag{9}$$

The estimates confirm statistical relevance of this relationship. First, estimates are significant in practically all the sectors. Second, the values of $S^2_{Y,X}$ confirm that, despite some sectoral variability, the explanatory power of productivity, net of the contribution of fixed effects and time dummies, is sizeable and ranges between around 30% and 60% of total variance explained by the model. The overall message is consistent with the evidence from contemporaneous yearly regressions.

Similar conclusions emerge also from Table 9, where we show the estimation results for the specification

$$\bar{G}_{i,s} = c + \alpha\bar{P}_{i,s} + u_i + \epsilon_{i,s} \quad , \tag{10}$$

focusing on the relation between average growth and average profitability. The estimates tend to be positive and significant, with the fraction of sectors displaying statistical significance rising up to 2/3. Still, comparisons of $S^2_{Y,X}$ with R^2 once again highlight that strength of the relationships is weak. With few exceptions, the small values of $S^2_{Y,X}$ imply that profitability can hardly contribute to more than 5-10% to overall explanatory power of the model captured by the R^2 (actually much less in most of the sectors).

As found in the case of contemporaneous yearly regression, estimates do not vary significantly if we augment the model introducing sectoral dummy regressors associated with taxonomies on ICT intensity, skill composition of the labour force and patterns of innovation.

Summarising, results are quite in accordance with what we find in the case of contemporaneous estimates. The productivity-profitability link turns out to be the only one where the explanatory power of the "systematic economic regressor" is comparable with, or even higher than that coming from firm-specific terms. Conversely, selection mechanisms are at best weak along the productivity-growth and the profitability-growth links. Moreover, such patterns do not display striking differences between the two countries and, despite some variations, tend to apply quite generally across sectors.

5 A weak selective hand of market competition? Some conclusions

The micro evidence presented in this work reinforces the robust stylised fact on widespread and persistent inter-firm heterogeneity revealed by widely different degrees of efficiencies. Such an evidence is also well in tune with an evolutionary notion of idiosyncratic learning, innovation (or lack of it) and adaptation. Heterogeneous firms compete with each other and, given (possibly firm-specific or location-specific) input and output prices, obtain different returns. Putting it in a different language, they obtain different "quasi-rent" or, conversely, losses above/below the notional "pure competition" profit rates. At the same time, market selection among firms – the other central mechanism at work, together with firm-specific learning, in evolutionary interpretations of economic change – does not seem to be particularly powerful, at least on the yearly or multi-yearly time scale at which statistics are reported (while the available time series are not generally long enough to precisely assess what happens in the very long run, say decades). Diverse degrees of efficiencies seem to yield primarily relatively persistent profitability differentials. That is, contemporary markets do not appear to be too effective selectors delivering rewards and punishments in terms of relative sizes or shares – no matter how measured – according to differential efficiencies. Moreover, the absence of any strong relationship between profitability and growth militates against the "naively Schumpeterian" (or for that matter "classic") notion that profits feed growth (by plausibly feeding investments). Selection amongst different variants of a technology, different vintages of equipment, different lines of production does occur and is a major driver of industrial dynamics. However, it seems to occur to a good extent within firms, driven by the implementation of "better" processes of production and the abandonment of older less productive ones. Finally, the same evidence appears to run against the conjecture, put forward in the '60s and '70s by the "managerial" theories of the firm on a trade off between profitability and growth with "managerialized" firms trying to maximize growth subject to a minimum profit constraint.[17]

Note that weakness of differential efficiency as direct or indirect driver of differential growth and inter-firm reallocation of resources, we have shown, robustly applies across different industrial sectors and across countries – in our case Italy and France – characterised by quite different institutional set-ups and forms of industrial organization. In turn, the observation that market selection that winnows directly on firms may play less of a role than that assumed in many models of evolutionary inspiration demands further advances in the understanding of how markets work (or do not), and of the structure of demand. Here note the following. First, one measures efficiency – supposedly a driver of differential selection – very imperfectly: we have already mentioned, as emphasized by Foster et al. (2008), that one ought to disentangle the price component of value added (and thus the price effect upon competitiveness) from physical efficiency to which productivity strictly speaking refers. This applies to homogeneous products and even more so when products differ in their characteristics and performances: as this is often the case in modern industries, one ought to explicitly account for the impact of the latter upon competitiveness and revealed selection processes. Second, but relatedly, the notion of generalised inter-industry competition is too heroic to hold. It might be more fruitful in many industries to think of different sub-market of different sizes as the locus of competition (cfr. Sutton, 1998). The characteristics and size of such sub-markets offer also different constraints and opportunities for corporate growth. Ferrari and Fiat operate in different submarkets, face different growth opportunities and do not compete with each other. However, the example is interesting also in another respect: Fiat can grow, as it actually happened, by acquiring Ferrari. But such a dynamics has little bearing on the relative initial productivities of Fiat and Ferrari. Third, in any case, the links between efficiency (and innovation), on the one hand, and corporate growth, on the other, are likely to be profoundly mediated by large degrees of behavioural freedom, in terms e.g. of propensities to invest, export, expand abroad; pricing strategies; patterns of diversification. In fact, such degrees of behavioral freedom can only be possible if market interactions occur over "selection landscapes" which are roughly flat over significant intervals. In turn, such a "flatness" is likely to be the consequence of various forms of market imperfections – including informational ones. Such imperfections, together with endemic satisfactory behaviours, allow firms characterised by diverse degrees of efficiency (and product qualities) to co-exist without too much competitive pressures.

The broad patterns discussed in this work need to be corroborated with evidence from other countries and on larger time periods. And, at least equally important, have to be matched by

[17]In fact the absence of such a trade off had been already noted by Barna (1962). Note also that this proposition is compatible with the finding that current growth appears to be correlated with future long-term profitability (cfr. Geroski et al., 1997).

complementary evidence on the impact of entry and exit. However, were they to hold, they bear far-reaching implications for theory, empirical analysis, and polices. On the side of both theory and empirical investigations, much more work awaits to be done on how markets work, the nature of competitive interactions and the dimensions over which competitive selection occurs, if any. On the policy side, a much more sobering view might have to be taken on the "magic of market competition". It could well be that policy measures aimed at *creative accumulation* of technological knowledge and equipment might be more effective in fostering progress than trying to wag the forces of *creative destruction*. Together, if proved robust, our evidence on the negligible impact of profit margins upon growth takes away a lot of plausibility to argument that taxing profits is bad for the economy because it harms growth. Rather, corporate growth seems to be driven much more by elusive and idiosyncratic "animal spirits".

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